

CLAIMS

1. A method comprising:

5 establishing a first electromagnetic radiation diffraction pattern resulting from interaction of electromagnetic radiation with a system including separate portions of a first sample;

changing the first sample to a second sample and establishing a second diffraction pattern resulting from interaction of electromagnetic radiation with the system including a second sample; and

determining the difference between the first and second diffraction patterns.

10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95

2. A method comprising:

exposing separate portions of a first sample to electromagnetic radiation, without exposing any portion of the first sample between the separate portions to the electromagnetic radiation, and determining absorption of the electromagnetic radiation by the first sample;

exposing separate portions of a second sample to electromagnetic radiation, without exposing portions of the second sample between the separate portions to the electromagnetic radiation and determining absorption of the electromagnetic radiation by the second sample; and

determining a difference in absorption of the second sample as compared to the first sample.

20

3. A method as in claim 2, further comprising establishing a first diffraction pattern resulting from interaction of electromagnetic radiation with a system including the separate portions of the first sample;

25 establishing a second diffraction pattern resulting from interaction of the electromagnetic radiation with the system including the second sample; and

determining the difference between the first and second diffraction patterns.

4. A method as in any preceding claim, wherein at least one of the first and second samples is two-dimensionally variant.

5. A method as in any preceding claim, wherein the separate portions of the first sample are isolated from each other, and the separate portions of the second sample are isolated from each other.

5

6. A method as in any preceding claim, wherein the separate portions of the first sample are exposed to electromagnetic radiation without exposing any portion of the first sample between the separate portions to the electromagnetic radiation, and separate portions of the second sample are exposed to electromagnetic radiation without exposing portions of the second sample between the separate portions to the electromagnetic radiation.

10
15
20
25

7. A method as in any preceding claim, involving determining absorption of the electromagnetic radiation by each of the first and second samples and determining a difference in absorption of the second sample compared with the first sample.

8. A method as in claim 7, involving simultaneously determining the first diffraction pattern and absorption of the first sample, and simultaneously determining the second diffraction pattern and absorption of the second sample.

20 9. A method as in any preceding claim, wherein the first and second samples are different fluids.

10. A method as in claim 9, wherein the first and second samples contain different concentrations of a species.

25

11. A method as in claim 9, wherein the first and second samples contain different species.

12. A method as in claim 9, wherein the first and second samples differ in absorption.

13. A method as in claim 12, wherein the first and second samples differ in refractive index.

14. A method as in claim 9, wherein the first and second samples differ in refractive index.

5 15. A method as in any preceding claim, wherein each of the first and second samples comprises a series of elongate, essentially parallel sections.

16. A method as in claim 15, wherein each of the first and the second samples is a different fluid.

40 17. A method as in claim 15, wherein the elongate sections comprise a series of different blocks of fluid.

18. A method as in any preceding claim, wherein each of the first and second samples is two-dimensionally variant, and the diffraction pattern is two-dimensionally variant.

15 19. A method as in claim 15, further comprising urging the sections in an axial direction thereby positioning the first sample at an axial location, and subsequently positioning the second sample at the same axial location.

20 20. A method as in claim 19, involving urging the sections in an axial direction via physical pressure.

25 21. A method as in claim 19, comprising urging the sections in an axial direction via electroosmosis.

22. A method as in any preceding claim, wherein each of the first and second samples is positioned in elongate voids in an article that is at least partially transparent to the electromagnetic radiation.

23. A method as in claim 22, wherein each of the first and second samples is positioned in indentations in a first chamber component including a plurality of protrusions and intervening indentations, the protrusions being sealed to a surface of a second chamber component.

5

24. A method as in any preceding claim, wherein each of the first and second samples is positioned in isolated, essentially parallel channels in a sample chamber.

10

25. A method as in claim 23, wherein the sample chamber includes at least one interior sample surface that is flexible.

15

26. A method as in claim 23, wherein the sample chamber includes at least one interior sample surface that is polymeric.

20

27. A method as in claim 23, wherein the sample chamber includes at least one interior sample surface that is elastomeric.

20

28. A method as in any preceding claim, wherein each of the first and second samples is positioned in isolated, essentially parallel channels in a sample chamber that is essentially transparent to the electromagnetic radiation.

29. A method comprising:

exposing a first surface of a first component and a second surface of a second component to plasma; and

25

contacting first portions of the first surface with the second surface while leaving a second portion of the first surface, intervening the first portions of the first surface, free of contact with the second surface.

30. A method as in claim 29, the contacting step comprising contacting a plurality of first portions of the first portions of the first surface, each of the first portions including a second portion that remains free of contact with the second surface, between it and another first portion.

5 31. A method as in claim 30, wherein the first portions are polymeric.

32. A method as in claim 30, wherein the first portions are elastomeric.

10 33. A method as in claim 29, wherein the first surface is a contoured surface including a plurality of protrusions and intervening indentations and the contacting step involves contacting outward-facing surfaces of the protrusions with the second surface.

15 34. A method as in claim 33, wherein the second surface is essentially flat.

35. A method as in claim 29, further comprising forming a seal between the first portions and the second surface.

20 36. A method as in claim 35, involving forming an irreversible seal between the first portions and the second surface.

37. A method as in claim 35, involving forming a seal between the first portions and the second surface that is impermeable to agents to which the first and second surfaces are resistant.

25 38. A method as in claim 29, wherein at least one of the first and second components is flexible.

39. A method as in claim 28, wherein at least one of the first and second components is polymeric.

40. A method as in claim 29, wherein at least one of the first and second components is elastomeric.

41. A method as in claim 29, the contacting step comprising defining, between the first 5 surface and the second surface, a plurality of isolated, essentially parallel, elongate channels.

42. A method as in claim 41, wherein each of the channels has a length at least three times its width.

43. A method as in claim 41, wherein the plurality of channels comprises at least five channels.

44. A method comprising:
providing a sample chamber formed according to claim 29; and
15 positioning a source of electromagnetic radiation directed at the sample chamber and a detector of electromagnetic radiation positioned to detect electromagnetic radiation emanating from the sample chamber.

45. A method as in claim 44, comprising positioning the detector to detect electromagnetic 20 radiation emitted by the emitter and passing through the sample chamber.

46. A method as in claim 45, wherein the detector is an electromagnetic absorption detector.

47. A method as in claim 45, wherein the detector is a diffraction pattern detector.

25 48. A method as in claim 44, further comprising providing a diffraction pattern detector positioned to detect a diffraction pattern resulting from interaction of the electromagnetic radiation and a sample in the sample chamber.

49. A method as in claim 44, further comprising providing a pump constructed and arranged to urge a sample through the chamber.

50. A method as in claim 49, wherein the pump is a physical pump.

51. A method as in claim 49, wherein the pump is an electroosmotic pump.

52. A system comprising:
a sample system constructed and arranged to position first and second portions of a sample separately and in isolation from each other;
at least one source of electromagnetic radiation positioned to irradiate the first and second portions; and
at least one absorption detector positioned to detect absorption of the first and second portions.

53. A system comprising:
a sample system constructed and arranged to position first and second portions of a sample separately and in isolation from each other;
a source of electromagnetic radiation positioned to irradiate the first and second portions;
a detector positioned to determine diffraction of the electromagnetic radiation by the first and second portions; and
a pump constructed and arranged to displace the first sample with a second sample.

54. A system as in claim 53, wherein the detector is constructed and arranged to detect a one-dimensional diffraction pattern.

55. A system as in claim 53, wherein the detector is constructed and arranged to detect a two-dimensional diffraction pattern.

56. A system as in claim 52, wherein the sample system comprises a sample chamber constructed and arranged to position the first and second portions of the sample separately and in isolation.

5 57. A system as in claim 56, wherein the sample chamber includes an interior chamber surface that is flexible.

58. A system as in claim 56, wherein the sample chamber includes an interior chamber surface that is polymeric.

16 59. A system as in claim 56, wherein the sample chamber includes an interior chamber surface that is elastomeric.

15 60. A system as in claim 53, wherein the sample chamber is formed of a first chamber component and a second chamber component sealed to each other via plasma activation in the absence of auxiliary adhesive.

20 61. A system as in claim 52, wherein the sample system comprises a sample chamber including a plurality of essentially parallel, elongate channels.

62. A system as in claim 61, wherein the channels comprise at least five channels.

25 63. A system as in claim 61, further comprising a pump constructed and arranged to urge samples through the channels.

64. A system as in claim 63, wherein the pump is an electroosmotic pump.

65. A system as in claim 64, wherein the electroosmotic pump comprises electrodes, in each channel, spaced axially in the channel.

10 66. A system as in claim 65, wherein the electrodes are pre-fabricated on a chip and the sample chamber is defined by the chip and a cover on the chip.

5 67. A system comprising:
a sample chamber defined by an elastomeric article having a first surface including a plurality of protrusions and indentations, outward-facing surfaces of the protrusions forming a seal against a surface of a second article, the indentations and portions of the surface of the second article defining a plurality of elongate, essentially parallel fluid channels constructed and arranged to receive a fluid and to pass the fluid through the channels;
a pump constructed and arranged to urge a sample through the channels;
at least one source of electromagnetic radiation positioned to irradiate a sample in the sample chamber channels;
a detector positioned to determine absorption of electromagnetic radiation directed at a sample in the sample chamber channels; and
a diffraction detector positioned to detect diffraction of electromagnetic radiation directed at a sample in the sample chamber channels.

20 68. A system as in claim 67, constructed and arranged to simultaneously determine absorption of electromagnetic radiation directed at a sample in the sample chamber channels and diffraction of electromagnetic radiation directed at a sample in the sample chamber channels.

25 69. A system as in claim 68, constructed and arranged to simultaneously determine absorption of electromagnetic radiation directed at a sample in the sample chamber channels and diffraction of electromagnetic radiation directed at a sample in the sample chamber channels, and to simultaneously determine absorption of electromagnetic radiation directed at a second sample in the sample chamber channels and diffraction of electromagnetic radiation directed at a second sample in the sample chamber channels and to determine a difference in absorption of the first

sample compared with the second sample and to determine a difference in diffraction of the first sample compared to the second sample.

70. A method comprising:

5 joining a pre-oxidized polymeric surface to a second pre-oxidized surface; and
allowing the polymeric surface and the second surface to form a liquid-impermeable seal
therebetween.

10 71. A method as in claim 70, comprising allowing the polymeric surface and the second
surface to form a liquid-impermeable seal therebetween in the absence of auxiliary adhesive.

15 72. A method as in claim 70, further comprising pre-oxidizing the polymeric surface and the
second surface by exposing the polymeric surface and the second surface to plasma.

20 73. A method as in claim 70, wherein the polymeric surface is a surface of a flexible article.

25 74. A method as in claim 70, wherein the polymeric surface is a surface of an elastomeric
article.

75. A method as in claim 70, wherein the joining step comprises joining the first portions of
the polymeric surface to the second surface while leaving a second portion of the polymeric
surface, intervening the first portions of the polymeric surface, free of contact with the second
surface.

76. A method as in claim 70, the joining step comprising contacting first portions of the
second surface with the polymeric surface while leaving a second portion of the second surface,
intervening the first portions of the second surface, free of contact with the polymeric surface.

77. A method as in claim 70, wherein the second surface is polymeric.

78. A method as in claim 70, wherein the second surface is metal.

80. A method comprising:
5 forming a siloxane bond between a first, conformable surface and a second surface.

81. A method as in claim 80, comprising forming of the siloxane bond in the absence of auxiliary adhesive.

82. A method as in claim 80, further comprising exposing the first surface and the second surface to plasma, then forming the siloxane bond.

83. A method as in claim 80, wherein the first surface is polymeric.

84. A method as in claim 80, wherein the first surface is flexible.

85. A method as in claim 80, wherein the first surface is elastomeric.

86. A method as in claim 80, wherein the second surface is polymeric.
20

87. A method as in claim 80, the forming step involving contacting first portions on the first surface with the second surface while leaving a second portion of the first surface, intervening the first portions of the first surface, free of contact with the second surface.

25 88. A method as in claim 80, the forming step involving contacting first portions on the second surface with the first surface while leaving a second portion of the second surface, intervening the first portions of the second surface, free of contact with the first surface.

89. A method as in claim 80, wherein the second surface is metal.

90. A method comprising:
 applying a polymeric surface to a second surface; and
 in the absence of auxiliary adhesive and at a temperature of between about 16 °C and
5 about 27 °C, allowing the polymeric surface and the second surface to bond to form a liquid-
 impermeable seal therebetween.

91. A method as in claim 90, further comprising pre-oxidizing the polymeric surface and the
 second surface prior to the applying step.

92. A method as in claim 90, further comprising exposing the polymeric surface and the
 second surface to plasma prior to the applying step.

93. A method as in claim 90, wherein the second surface is polymeric.

94. A method as in claim 90, wherein the first surface is flexible.

95. A method as in claim 90, wherein the first surface is elastomeric.

20 96. A method as in claim 90, the applying step comprising contacting first portions on the
 first surface with the second surface while leaving a second portion of the first surface,
 intervening the first portions of the first surface, free of contact with the second surface.

25 97. A method as in claim 90, the applying step comprising contacting first portions on the
 second surface with the first surface while leaving a second portion of the second surface,
 intervening the first portions of the second surface, free of contact with the first surface.

98. A method as in claim 90, wherein the second surface is metal.

99. An article comprising:
a polymeric component having a surface bonded to a surface of a second component in
the absence of auxiliary adhesive thereby defining a liquid-impermeable seal therebetween.

5 100. An article as in claim 99, wherein the surface of the polymeric component is bonded to
the surface of the second component via siloxane bonding.

10 101. An article as in claim 99, wherein first portions of the surface of the polymeric
component are bonded to the surface of the second component while a second portion of the
surface of the polymeric component, intervening the first portions of the surface of the polymeric
component, is free of contact with the surface of the second component.

10 102. An article as in claim 99, wherein first portions of the surface of the second component
are bonded to the surface of the polymeric component while a second portion of the surface of
the second component, intervening the first portions of the surface of the second component, is
free of contact with the surface of the polymeric component.

15 103. An article as in claim 99, wherein the surface of the second component is metal.

20 104. A method comprising:
inducing electroosmotic fluid flow in a channel, an interior surface of which is defined at
least in part by polymeric material.

25 105. A system comprising:
a channel, an interior surface of which is defined at least in part by polymeric material;
and
electrical circuitry positioned to apply an electrical field along the channel.

106. A method comprising:

exposing a surface of a first article to a pretreatment step, absent auxiliary adhesive, that both promotes bonding of the surface to another surface and primes the first surface for a predetermined chemical modification;

5 defining a channel between the first article and a second article by joining portions of the surface of the first article to portions of a surface of the second article and allowing joined portions of the first and second articles to bond to form a liquid-impermeable seal therebetween promoted by the pretreatment step; and

effecting the predetermined chemical modification at an interior surface of the channel primed by the pretreatment step.

PCT/US2015/035075

107. A method comprising:

exposing a surface of a first article to a pretreatment step, absent auxiliary adhesive, that both promotes bonding of the surface to another surface and primes the first surface for enhanced fluid flow against it;

defining a channel between the first article and a second article by joining portions of the surface of the first article to portions of a surface of the second article and allowing joined portions of the first and second articles to bond to form a liquid-impermeable seal therebetween promoted by the pretreatment step; and

20 urging fluid flow in the channel at a first fluid flow rate under conditions at which, in the absence of the pretreatment step, the fluid would flow at a second fluid flow rate less than the first rate.

108. A method as in claim 33, comprising forming a plasma-activated seal in the absence of auxiliary adhesive.